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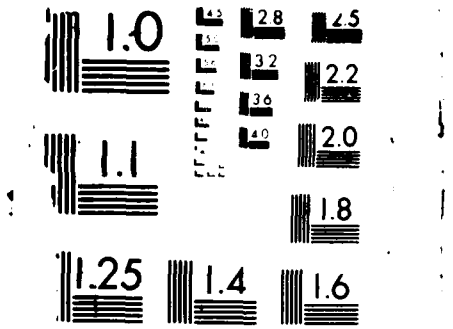

MICROCOPY RESOLUTION TEST CHART

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18. Linear and nonlinear partial differential equations, elliptic, hyperbolic, a priori estimates. Minimal surfaces, Probabilistic methods, Brownian motion, random walk, recursion theory, Variational methods. Vibration problems. Flame propagation, symmetry and antisymmetry of solutions. Singular solutions of Euler equations. Best constants in Sobolev inequalities. Semilinear equations in R^n. Analytic methods in topology: Reidemeister torsion. Hamiltonian systems.

19. Elliptic equations: Much work has been done, especially for nonlinear, involving (i) new a priori estimates, (ii) variational methods and (iii) Brownian motion.

Nirenberg and collaborators have written a series of papers on fully nonlinear elliptic equations — involving (i). For a function u in a domain they have studied equations of two types:

$$f(\lambda(u_{ij}(x))) = \psi(x) \qquad (1)$$

$$f(\kappa(\text{graph of } u)) = \psi(x) \qquad (2)$$

Here λ represents the eigenvalues of the Hessian, while κ represents the principal curvatures of the graph $(x,u(x))$. They consider various classes of symmetric (under permutation) functions f which are increasing in each argument (this is ellipticity) and concave. The new a priori estimates also yield an extension of the classical Bernstein theorem for a function u defined on R^n satisfying the minimal surface equation; they prove: if $\nabla u(x) = o(|x|)$ at infinity then u is affine. Surprisingly, the result also extends to solutions of certain equations of the form (2). Vinacua has extended the results for (1) to the complex case.

With Berestycki, Nirenberg has proved uniqueness, and other properties, for solutions of a semilinear elliptic equation in an infinite strip — representing a model of flame propagation. In addition they have studied questions of symmetry and antisymmetry. Grillakis and Jones have found radial solutions for classes of semilinear elliptic equations in R^n, which change sign. Thomann and Escobar worked on a problem (arising in geometry) of finding best constant in the Sobolev immersion $W^{1,p}(R^n_+)$ into $L^q(R^{n-1})$, $q = p(n-1)/(n-p)$; tney solved the corresponding Euler Lagrange equation.

March has studied Brownian motion on complete simply connected manifolds. In addition he has worked on the connections between recursion theory and the discrete random Schrödinger equation with applications to the smoothness of the density of states in one dimension. Work has been done on random walk. Exending methods of Witten, Tangerman has given new analytic proofs of results of Ray and Singer and connections between topology (torsion) and geometry of manifolds.

Nonlinear hyperbolic equations. Various problems have been investigated: 1. Asymptotic behavior of solutions of the Klein Gordon equation. 2. Improved abstract theory of stability and instability of orbital solutions of infinite dimensional Hamiltonian systems. 3. Existence of nontrivial time-periodic solutions on the sphere S^n of semilinear wave equations — these results, of Zhou, include all previously known ones.

Fluid dynammics. Thomann and collaborator extended work of DiPerna and Majda on weak, singualr, solutions of the Euler equations in 2-dimensions by showing that certain kinds of singular solutions were simply not possible.

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